

US LHC Accelerator Project		Baseline Change Request
BCR Number	37	
WBS	1.1 Interaction Regions	
	1.2 RF Region	
Title	Update delivery milestones	
Change Control Level	2	
Originator	J. Strait	
Date	10 October 2001	

### **Description of change**

This baseline change updates the level 2 milestones for delivery of equipment to CERN for installation in the LHC Insertion Regions. This set of milestones also forms Appendix 2 of the Implementing Arrangement, which will be updated together with the level 2 controlled milestone table.

### **Reason for change**

The current set of delivery milestones was established in 1998, at the time that the Implementing Arrangement was written, and was based on the version of LHC installation schedule then current. Both the LHC installation schedule and the production schedules for the US-provided equipment have changed significantly since then, making necessary the development of a new set of milestone dates that corresponds to the current plan.

### **Impact on other sub-systems**

None

### **Impact on cost**

None. The milestones changed here are related to the CERN installation schedule, not to the US Project production schedule. The latter is not changed by this BCR. As discussed below, the current production schedule is consistent with the new set of milestones given here.

### **Impact on schedule**

Old Milestone Table The delivery milestones covered by this BCR, with their current baseline dates, are shown in Table 1. In contrast to other milestones, which are tied to the schedule for development and production of the US-provided equipment, these milestones represent the latest date by which all equipment for a given region of the LHC must be received by CERN to ensure that installation can proceed according to schedule. Thus these milestones are derived from the CERN installation schedule.

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Table 1. Current baseline milestones for delivery of equipment to CERN.

Milestone No.		Baseline Date
	WBS 1.1 Interaction Regions	
2 -1.1- 11 C	Delivery of D2 for IR8 left	1 Apr 2002
2 -1.1- 13 C	Delivery of all inner triplet system components for IR8 left (MQX, DFBX, D1)	1 Oct 2002
2 -1.1- 14 C	Delivery of D2 for IR5 left	1 Nov 2002
2 -1.1- 16 C	Delivery of all inner triplet system components for IR8 right (MQX, DFBX, D1)	1 Jan 2003
2 -1.1- 17 C	Delivery of D2 for IR8 right	1 Feb 2003
2 -1.1- 19 C	Delivery of all inner triplet system components for IR1 left (MQX,DFBX,TAS,TAN)	1 Jul 2003
2 -1.1- 20 C	Delivery of D2 for IR2 right	1 Sep 2003
2 -1.1- 22 C	Delivery of D2 for IR1 left	1 Dec 2003
2 -1.1- 23 C	Delivery of all inner triplet system components for IR5 left (MQX,DFBX,TAS,TAN)	1 Jan 2004
2 -1.1- 24 C	Delivery of D2 for IR5 right	1 Mar 2004
2 -1.1- 25 C	Delivery of all inner triplet system components for IR5 right(MQX,DFBX,TAS,TAN)	1 Apr 2004
2 -1.1- 26 C	Delivery of all inner triplet system components for IR2 right (MQX, DFBX, D1)	1 Apr 2004
2 -1.1- 27 C	Delivery of all inner triplet system components for IR1 right(MQX,DFBX,TAS,TAN)	1 Jul 2004
2 -1.1- 28 C	Delivery of D2 for IR1 right	1 Aug 2004
2 -1.1- 29 C	Delivery of D2 for IR2 left	1 Sep 2004
2 -1.1- 32 C	Delivery of all inner triplet system components for IR2 left (MQX, DFBX, D1)	1 Oct 2004
	WBS 1.2 RF Region	
2 -1.2- 4 C	Delivery of D3, D4 for IR4 right	1 Jan 2002
2 -1.2- 6 C	Delivery of D3, D4 for IR4 left	1 Nov 2002

LHC Installation Schedule The current LHC installation schedule is given in LHC Project Document Number LHC-PM-MS-0009 rev. 2.0, 23 May 2001. This schedule shows the installation periods for the arcs, but not for the insertions. In discussions between Doug Fisher and Pierre Bonnal[1] and between Jim Strait and Ranko Ostojic[2,3], it was agreed that the installation period for each half insertion would correspond to the last four months of the installation period for the adjacent arc.

The current installation schedule, with the insertion installation periods overlaid, is included as Attachment 1. The date on the official installation schedule for the end of each arc installation is taken to correspond to the end of the month shown. The date for the beginning of each half-insertion installation period is the first of the month shown. In the original CERN installation plan, the inner triplet system was installed at a separate time from the D2 dipoles. In the current plan, all insertion components, including all of the US-provided equipment, are installed in the periods shown in the Attachment 1.

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To allow for incoming inspection, measurements and tests performed after receipt, and installation of CERN-provided equipment (e.g. beam screens), all equipment must be delivered to CERN by at latest three months prior to the start of installation. Thus the delivery milestones are three months earlier than the dates shown in Attachment 1.

Expected US Delivery Dates The expected dates for the arrival at CERN of the US-provided equipment are shown in Table 2. For the quadrupoles, these are taken from the BCR30 baseline schedule. For the dipoles, they are taken from the schedule corresponding to BCR 32, which is currently in draft form. For the absorbers, they are taken from the BCR27 baseline schedule. For the DFBX, the dates are taken from the draft schedule associated with BCR28, which has not yet been approved. These dates are included here for information purposes only. Some dates which are not part of the baseline are used here, since they are better estimates than the baseline dates for those items; however, their use does *not* establish new baseline schedules for those items.

The latest delivery for each half insertion is shown in bold font. For the interaction regions, this is in all cases a Q1 magnet, and for the RF region it is a D3 magnet.

Table 2. Expected delivery dates.

IP	CURRENT "ON DOCK AT CERN" DELIVERY DATES									
	Q1	Q2	Q3	TAS	TAN	DFBX	D1	D2	D3	D4
8L	<b>25 Mar 03</b>	20 May 02	2 Dec 02			7 Mar 03	15 Jan 02	15 May 02		
1R	<b>3 Jul 03</b>	5 Nov 02	27 Feb 03			17 Apr 03		15 Jul 02		
2L	<b>10 Oct 03</b>	28 May 03	27 Mar 03	3 Jan 03	27 Aug 02	13 Aug 03	15 Feb 02	15 Aug 02		
1L	<b>5 Jan 04</b>	27 Jun 03	15 May 03			13 Aug 03		15 Sep 02		
8R	<b>23 Mar 04</b>	25 Aug 03	23 Aug 03			24 Oct 03	15 Mar 02	15 Oct 02		
2R	<b>20 Apr 04</b>	21 Oct 03	7 Nov 03	3 Jan 03	27 Aug 02	24 Oct 03	15 Apr 02	15 Nov 02		
4L									<b>15 May 03</b>	15 Feb 03
4R									<b>15 Jun 03</b>	15 Mar 03
5L	<b>18 May 04</b>	18 Dec 03	3 Feb 04	3 Jan 03	27 Aug 02	14 Jan 04		15 Dec 02		
5R	<b>13 Aug 04</b>	20 Feb 04	16 Jun 04	3 Jan 03	27 Aug 02	14 Jan 04		15 Jan 03		

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New Milestone Table Table 3 shows the installation periods, the proposed milestones, the expected dates on which the milestones would be achieved under the current schedule, and the float between expected delivery and the milestone date. The last columns show the current milestones for delivery of the inner triplet system (IT), consisting of Q1-Q3, DFBX and D1, and the D2. Figure 1 displays the milestones and expected delivery dates graphically, and shows that typically the US Project will be two or more half-insertions ahead of the installation schedule.

Table 3. Installation periods, proposed milestones, and expected delivery dates.

Location: IR-	Installation Period		Proposed Milestone	Expected Delivery	Float mo	Current Milestone	
	Beginning	End				IT	D2
8L	1 Jan 04	30 Apr 04	1 Oct 03	25 Mar 03	6.2	1 Oct 02	1 Apr 02
1R	1 Jun 04	30 Sep 04	1 Mar 04	3 Jul 03	8.0	1 Jul 04	1 Aug 04
2L	1 Jun 04	30 Sep 04	1 Mar 04	10 Oct 03	4.7	1 Oct 04	1 Sep 04
1L	1 Oct 04	31 Jan 05	1 Jul 04	5 Jan 04	5.9	1 Jul 03	1 Dec 03
8R	1 Oct 04	31 Jan 05	1 Jul 04	23 Mar 04	3.3	1 Jan 03	1 Feb 03
2R	1 Dec 04	31 Mar 05	1 Sep 04	20 Apr 04	4.4	1 Apr 04	1 Sep 03
4L	1 Jan 05	30 Apr 05	1 Oct 04	15 May 03	16.6	1 Nov 02	
4R	1 Aug 05	30 Nov 05	1 May 05	15 Jun 03	22.6	1 Jan 02	
5L	1 Aug 05	30 Nov 05	1 May 05	18 May 04	11.4	1 Jan 04	1 Nov 02
5R	1 Sep 05	31 Dec 05	1 Jun 05	13 Aug 04	9.6	1 Apr 04	1 Mar 04

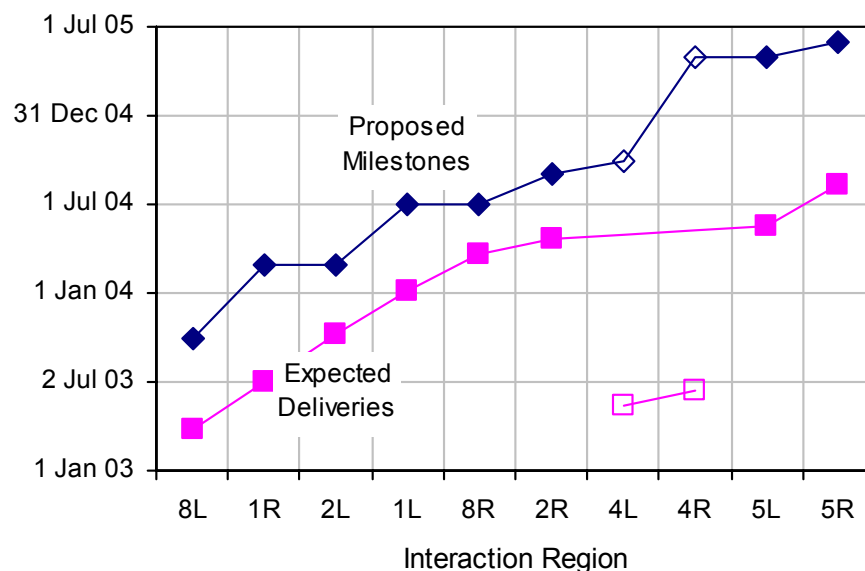


Figure 1. Proposed milestones and expected deliveries.

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New Baseline Milestones The proposed new baseline milestones are shown in Table 4. The milestones for the separate delivery of D2 have been deleted, and D2 has been added to the list of components that go with each half insertion. The definition of the completion of each milestone remains the arrival on the CERN loading dock of the last component corresponding to each half insertion. Note that since the order of installation has changed, the milestones are no longer in chronological order.

Table 4. Proposed new baseline milestones for delivery of equipment to CERN.

Milestone No.		Baseline Date
	WBS 1.1 Interaction Regions	
<del>2 -1.1- 11 C</del>	<del>Delivery of D2 for IR8 left</del>	<del>Deleted</del>
2 -1.1- 13 C	Delivery of all inner triplet system components for IR8 left (MQX, DFBX, D1, D2)	1 Oct 2003
<del>2 -1.1- 14 C</del>	<del>Delivery of D2 for IR5 left</del>	<del>Deleted</del>
2 -1.1- 16 C	Delivery of all inner triplet system components for IR8 right (MQX, DFBX, D1, D2)	1 Jul 2004
<del>2 -1.1- 17 C</del>	<del>Delivery of D2 for IR8 right</del>	<del>Deleted</del>
2 -1.1- 19 C	Delivery of all inner triplet system components for IR1 left (MQX, DFBX, D2, TAS, TAN)	1 Jul 2004
<del>2 -1.1- 20 C</del>	<del>Delivery of D2 for IR2 right</del>	<del>Deleted</del>
<del>2 -1.1- 22 C</del>	<del>Delivery of D2 for IR1 left</del>	<del>Deleted</del>
2 -1.1- 23 C	Delivery of all inner triplet system components for IR5 left (MQX, DFBX, D2, TAS, TAN)	1 May 2005
<del>2 -1.1- 24 C</del>	<del>Delivery of D2 for IR5 right</del>	<del>Deleted</del>
2 -1.1- 25 C	Delivery of all inner triplet system components for IR5 right (MQX, DFBX, D2, TAS, TAN)	1 Jun 2005
2 -1.1- 26 C	Delivery of all inner triplet system components for IR2 right (MQX, DFBX, D1, D2)	1 Sep 2004
2 -1.1- 27 C	Delivery of all inner triplet system components for IR1 right (MQX, DFBX, D2, TAS, TAN)	1 Mar 2004
<del>2 -1.1- 28 C</del>	<del>Delivery of D2 for IR1 right</del>	<del>Deleted</del>
<del>2 -1.1- 29 C</del>	<del>Delivery of D2 for IR2 left</del>	<del>Deleted</del>
2 -1.1- 32 C	Delivery of all inner triplet system components for IR2 left (MQX, DFBX, D1, D2)	1 Mar 2004
	WBS 1.2 RF Region	
2 -1.2- 4 C	Delivery of D3, D4 for IR4 right	1 May 2005
2 -1.2- 6 C	Delivery of D3, D4 for IR4 left	1 Oct 2004

A copy of the proposed new Appendix 2, which contains the new milestone list, is included as Attachment 2 to this BCR.

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**Other impacts (ES&H, etc.)**

None

**Change Control Board recommendation (if required)**

**References**

- 1) D. Fisher, Foreign Travel Trip Report, Travel to CERN September 8-19, 2001.
- 2) J. Strait, Foreign Travel Trip Report, Travel to CERN September 22-27, 2001.
- 3) J. Strait, Delivery Milestones, e-mail to R. Ostojic, 28 September 2001;  
R. Ostojic, Re: Delivery Milestones, e-mail to J. Strait, 3 October 2001.

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## Approvals

To change these milestones, and to change Appendix 2 of the Implementing Arrangement requires "the approval of the U.S. Project Manager and of the LHC Project Leader or his designee" [Implementing Arrangement, section IV, June 1998]. Tom Taylor has been designated the official CERN liaison to the US Project (see Appendix 1 of the Implementing Arrangement). His approval of this change is given in Attachment 3.

\_\_\_\_\_  
WBS Level 3 Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Laboratory Project Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Change Control Board Chair

\_\_\_\_\_  
Date

\_\_\_\_\_  
US LHC Accelerator Project Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
DOE LHC Project Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Director, DOE Division of High Energy Physics

\_\_\_\_\_  
Date

# LHC Project

## Summary Installation Schedule

*LHC Project Document No.*

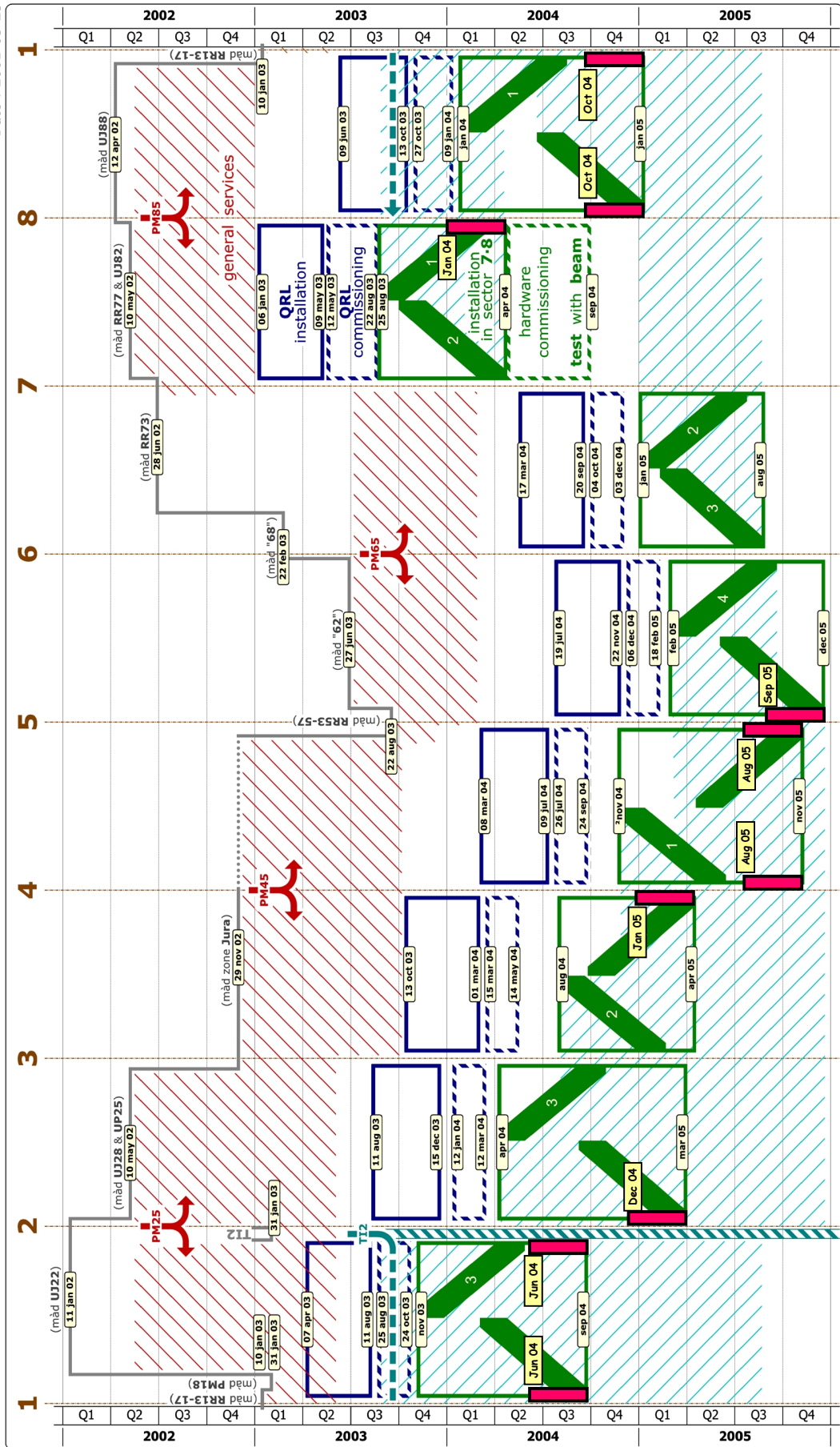
**LHC-PM-MS-0009 rev. 2.0**

CERN Div./Group or Supplier/Contractor Document No.

## AC/TCP

311826

Date : 2001-05-23



BCR 37 Attachment 2  
Proposed new Appendix 2 to the Implementing Arrangement

Implementing Arrangement to the Accelerator Protocol  
Between CERN and the U.S. DOE  
Concerning Scientific and Technical Cooperation on the LHC

Appendix 2  
Principal Milestones  
(Revised October 2001)

<u>Action</u>	<u>Date</u>
Decision as to whether or not the U.S. Project includes RF region quadrupoles	1 Jul 2001
Delivery of all inner triplet system components for IR8 left	1 Oct 03
Delivery of all inner triplet system componnets for IR1 right	1 Mar 04
Delivery of all inner triplet system components for IR2 left	1 Mar 04
Delivery of all inner triplet system components for IR1 left	1 Jul 04
Delivery of all inner triplet system componnets for IR8 right	1 Jul 04
Delivery of all inner triplet system componnets for IR2 right	1 Sep 04
Delivery of D3, D4 for IR4 left	1 Oct 04
Delivery of D3, D4 for IR4 right	1 May 05
Delivery of all inner triplet system components for IR5 left	1 May 05
Delivery of all inner triplet system componnets for IR5 right	1 Jun 05

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Note: An inner triplet system consists of all of the equipment for one interaction region specified under WBS 1.1 (see Table I and the WBS dictionary in section II.B).

BCR 37 Attachment 3  
CERN Approval of BCR 37 Milestone Changes

